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# NASA TECHNICAL MEMORANDUM

NASA TM-78194

## THE MSFC SILICON GATE SILICON-ON-SAPPHIRE STANDARD CELL LIBRARY

By Design Techniques Branch
Electronics Development Division
Electronics and Control Laboratory

September 1978

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*George C. Marshall Space Flight Center*
*Marshall Space Flight Center, Alabama*

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MSFC - Form 3190 (Rev June 1971)

TECHNICAL REPORT STANDARD TITLE PAGE

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| NASA TM-78194 | | |

| 4. TITLE AND SUBTITLE | 5. REPORT DATE |
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| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Design Techniques Branch<br>Electronics Development Division, E&C Laboratory<br>Marshall Space Flight Center, Alabama 35812 | 10. WORK UNIT NO. |
| | 11. CONTRACT OR GRANT NO. |
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This document is a pictorial representation of the MSFC Silicon-On-Sapphire Standard Cell Library. The cells are intended to be used with the PR2D (Place, Route in 2 Dimensions) Automatic Layout Computer Program.

17. KEY WORDS

| 19. SECURITY CLASSIF. (of this report) | 20. SECURIT' |
|---|---|
| Unclassified | Un |

MSFC - Form 3292 (Rev. December 1972)

# THE
# MSFC SILICON GATE
# SILICON ON SAPPHIRE
# STANDARD CELL LIBRARY
# (with wire bond)

This is a pictorial representation of the MSFC silicon gate, silicon on sapphire standard cell library (for wire bond) revision B dated July 22, 1974. The cells are intended for use with the PR2D program. They were designed by RCA or MSFC as indicated in the cell listing below. Each major grid line represents 1 mil on the chip, minor grid lines represent 0.5, 0.2, or 0.1 mil. One major grid line pair extends beyond the frame, thus pinpointing the location of the cell reference point. Each cell is identified by the technology code "N" and its cell number. The level is indicated below each frame. If no geometry is required on a particular level, the level picture is not shown (dummy levels). Some cells require identical geometries on two or more levels. In this case the geometry is shown only once. The cell listing denotes such duplicate levels.

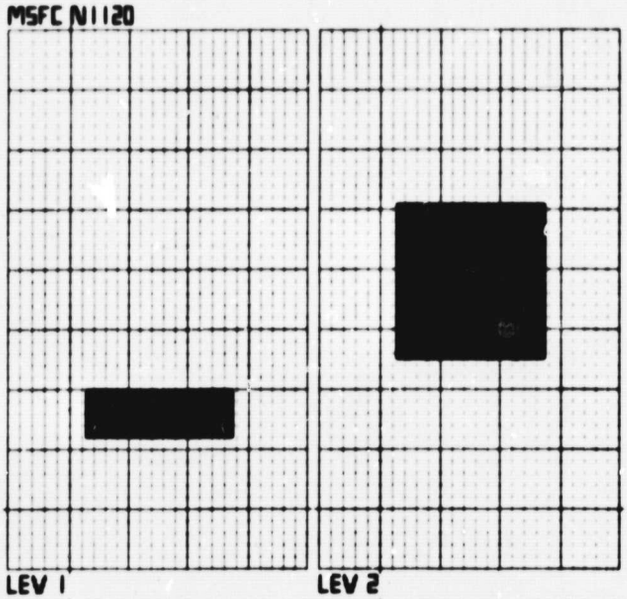
## CELL LISTING

| CELL # | | DUMMY LEVEL(S) | DUPLICATE LEVEL(S) | SOURCE |
|---|---|---|---|---|
| 1120 | 2 - Input NOR gate | 7 | - | RCA |
| 1130 | 3 - Input NOR gate | 7 | - | RCA |
| 1140 | 4 - Input NOR gate | 7 | - | RCA |
| 1220 | 2 - Input NAND gate | 7 | - | RCA |
| 1230 | 3 - Input NAND gate | 7 | - | RCA |
| 1240 | 4 - Input NAND gate | 7 | - | RCA |
| 1310 | Inverter | 7 | - | RCA |
| 1330 | $x = B \cdot A + \overline{B} \cdot C$ | 7 | - | RCA |
| 1340 | $x = \overline{B \cdot A + \overline{B} \cdot C}$ | 7 | - | RCA |
| 1510 | Non-Inverter Buffer | 7 | - | RCA |
| 1520 | Buffer Inverter | 7 | - | RCA |
| 1620 | 2 - Input AND gate | 7 | - | RCA |
| 1630 | 3 - Input AND gate | 7 | - | RCA |
| 1640 | 4 - Input AND gate | 7 | - | RCA |
| 1720 | 2 - Input OR gate | 7 | - | RCA |
| 1890 | 3 x 2 - Input AND - 3 X NOR gate | 7 | - | RCA |
| 1910 | $x = \overline{A \cdot B + B \cdot C + C \cdot D}$ | 7 | - | RCA |
| 1920 | $x = \overline{A \cdot B \cdot C}$; $Y = \overline{B \cdot C}$ | 7 | - | RCA |
| 2310 | 2 - Input exclusive OR gate | 7 | - | RCA |
| 2820 | D-Master - Slave flip flop | 7 | - | RCA |

## CELL LISTING (Continued)

| CELL # | FUNCTION | DUMMY LEVEL(S) | DUPLICATE LEVEL(S) | SOURCE |
|---|---|---|---|---|
| 9010 | Input Pad | 2 | - | RCA |
| 9060 | VDD Buffer Inverter Pad | - | 7=level 7 of cell 9010 | RCA |
| 9070 | GND Buffer Inverter Pad | - | 7=level 7 of cell 9010 | RCA |
| 9100 | Ground Pad | 2, 3, 4, 5 | 7=level 7 of cell 9010 | RCA |
| 9110 | VDD Pad | 2, 3, 4, 5 | 7=level 7 of cell 9010 | RCA |
| 9210 | On-chip alignment mark | - | - | RCA |
| 9220 | On-chip alignment mark | - | - | RCA |
| 9250 | Off-chip alignment mark | - | 2=4=5=7=lev. 1;6=lev. 3 | RCA |
| 9260 | Off-chip alignment mark | - | 2=4=5=7=lev. 1;6=lev. 3 | MSFC |
| 9310 | P - Test Transistor | 1, 4 | - | RCA |
| 9320 | N =Test Transistor | - | - | RCA |
| 9400 | Level Identification | - | - | MSFC |
| 9410 | Identification "NASA N" | - | 2=3=4=5=6=7=lev. 1 | MSFC |
| 9420 | Identification "MSFC N" (all levels) | - | 2=3=4=5=6=7=lev. 1 | MSFC |
| 9430 | Identification "MSFC N" (lev. 6 only) | 1, 2, 3, 4, 5, 7 | 6=lev 1 of cell 9420 | MSFC |
| 9440 | Identification "N" (lev. 6 only) | 1, 2, 3, 4, 5, 7 | - | MSFC |
| 9450 | Identification "MSFC" (lev. 6 only) | 1, 2, 3, 4, 5, 7 | - | MSFC |
| 9500 | Feedthrough | 1, 2, 4, 7 | - | RCA |
| 9700 To 9790 | Numeric Characters 0-9 (all levels) | - | 2=3=4=5=6=7=lev. 1 | RCA |
| 9800 To 9890 | Numeric Characters 0-9 (lev. 6 only) | 1, 2, 3, 4, 5, 7 | 6=level 1 of Cell Group 9700/9790 | MSFC |

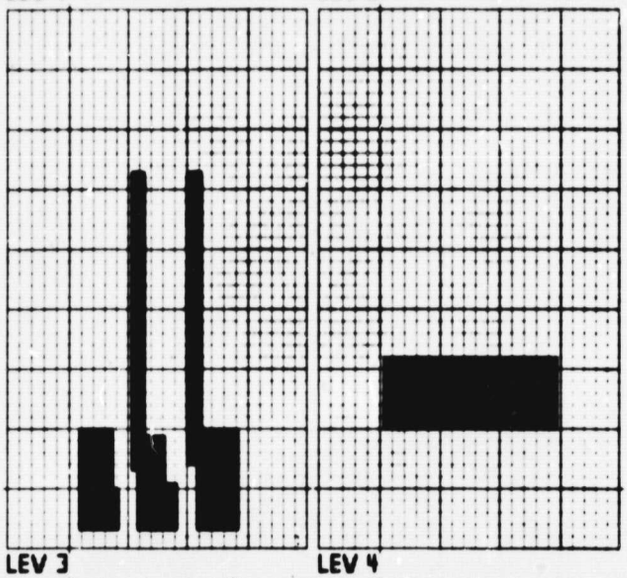
MSFC N1120



LEV 1



LEV 2



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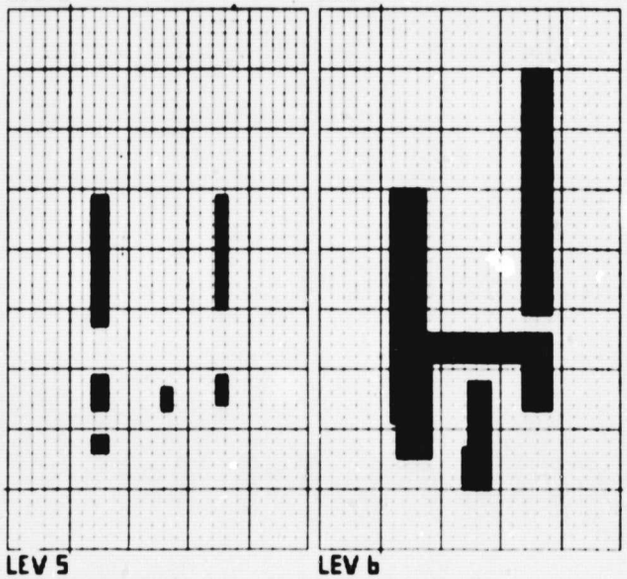
LEV 4



LEV 5



LEV 6

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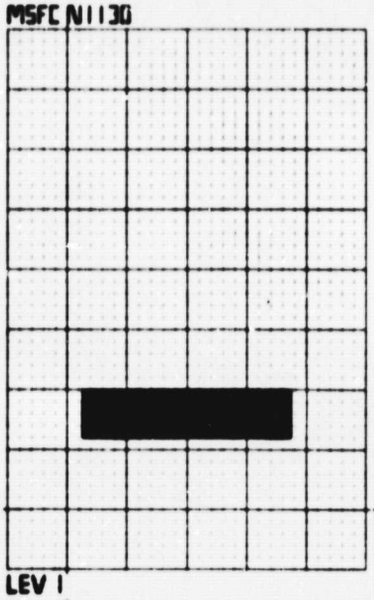

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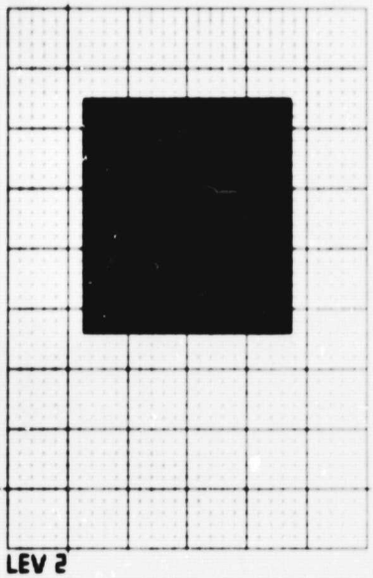

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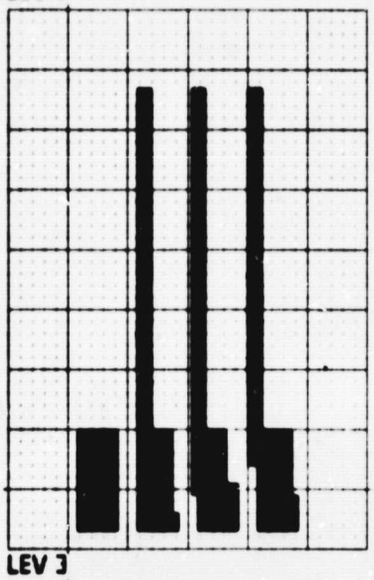

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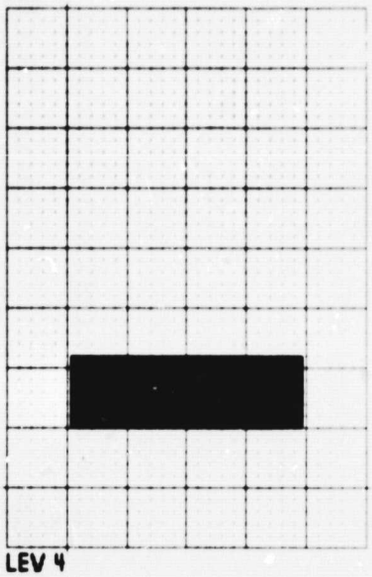

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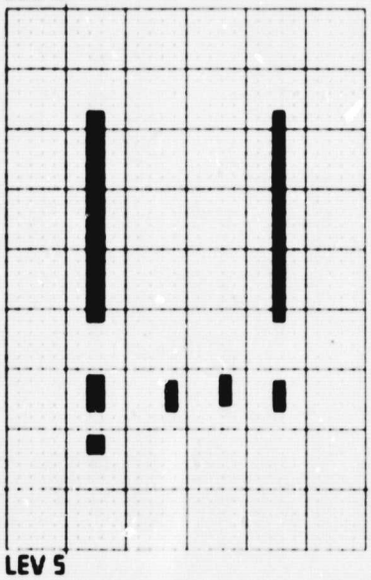

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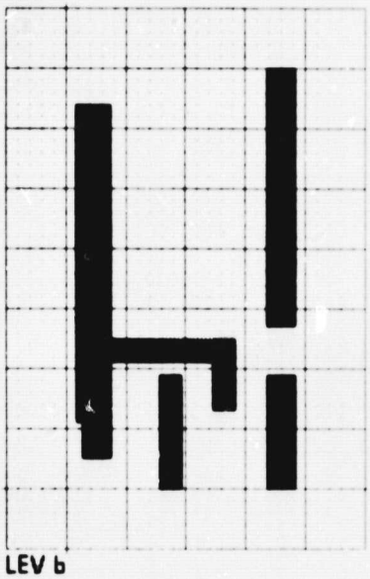

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MSFC N1140

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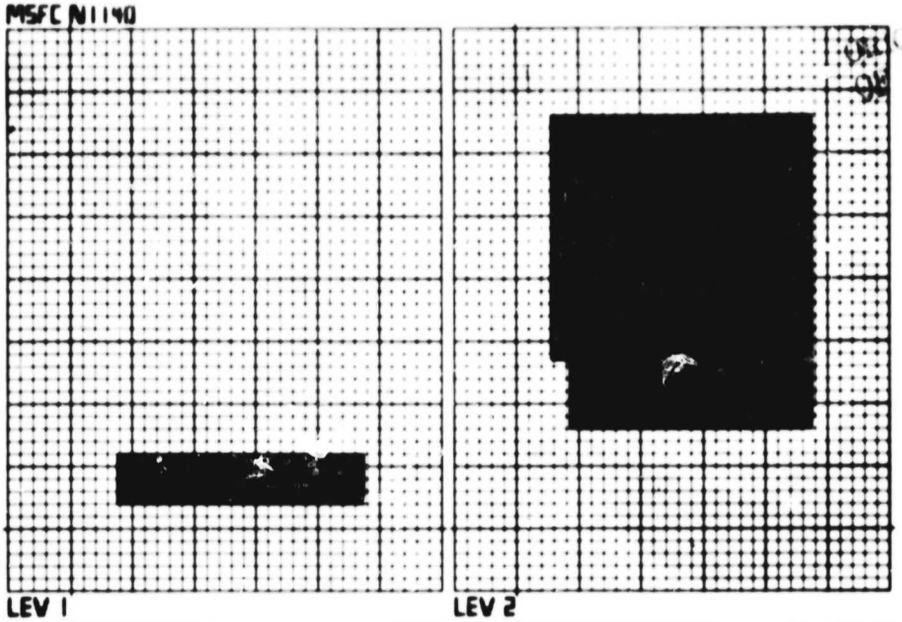

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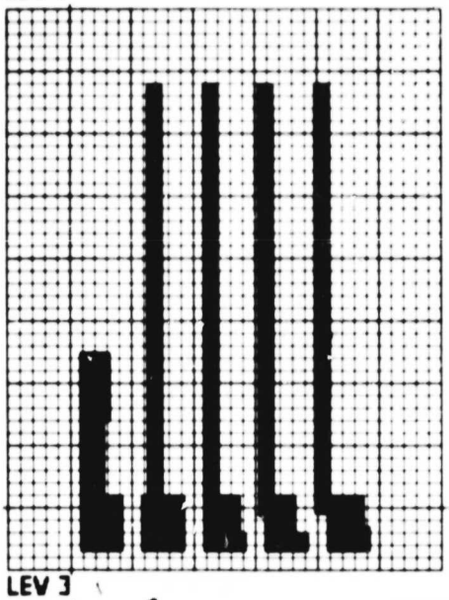

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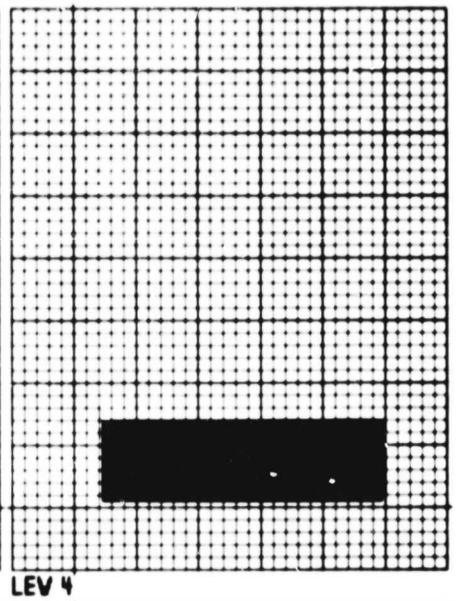

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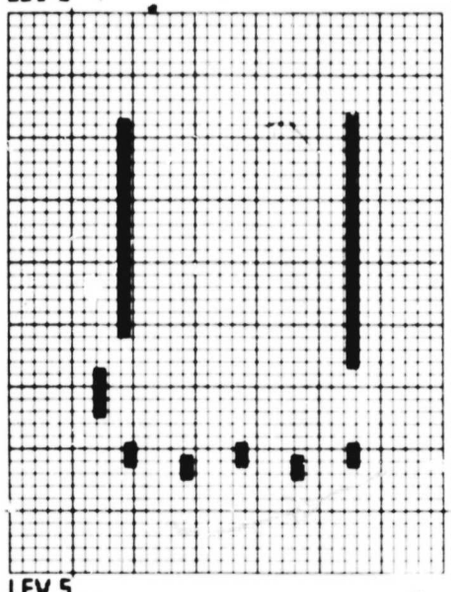

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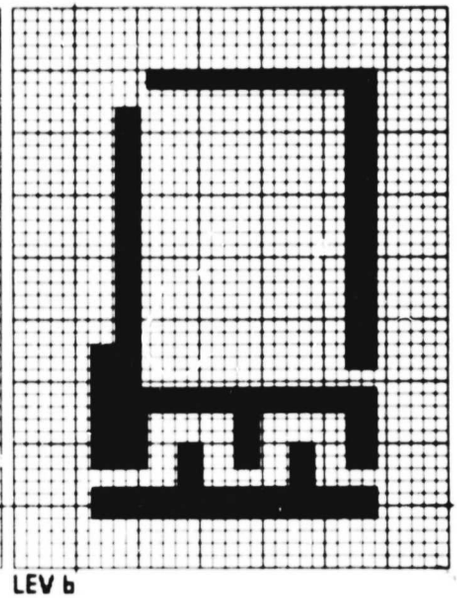

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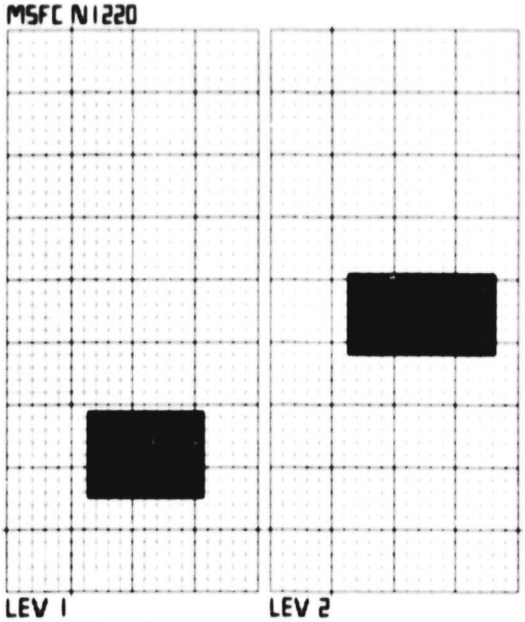

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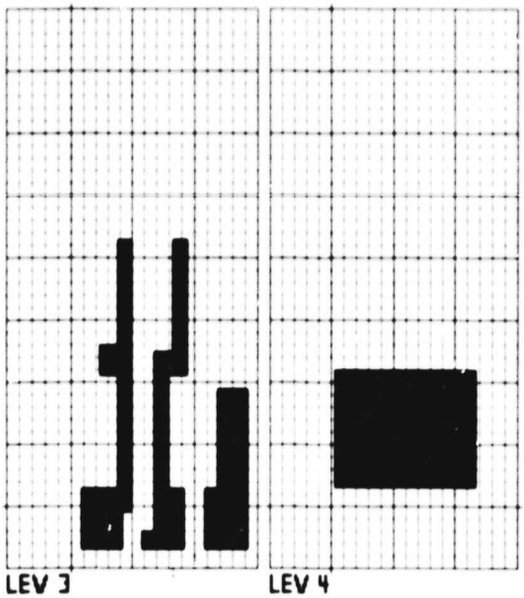

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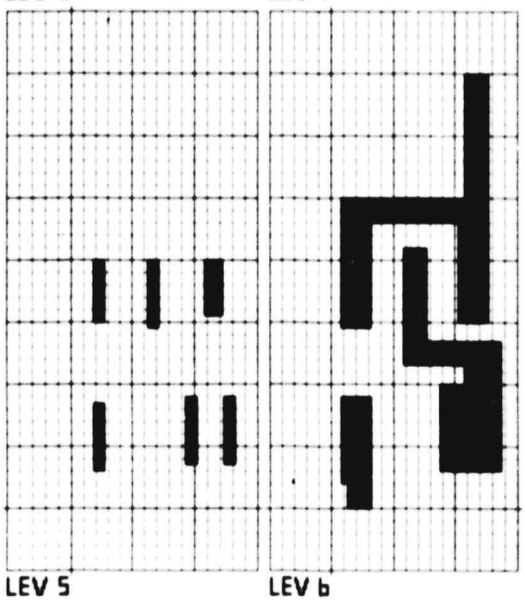

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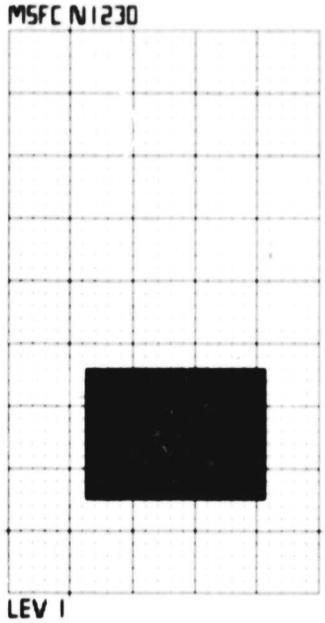

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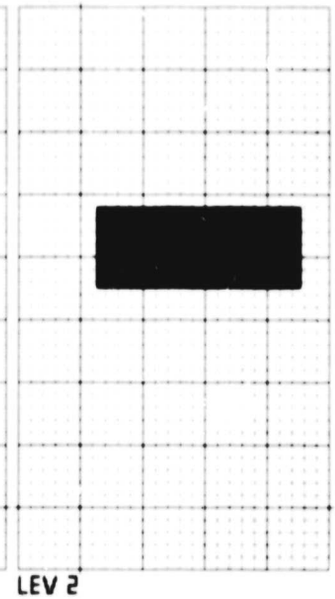

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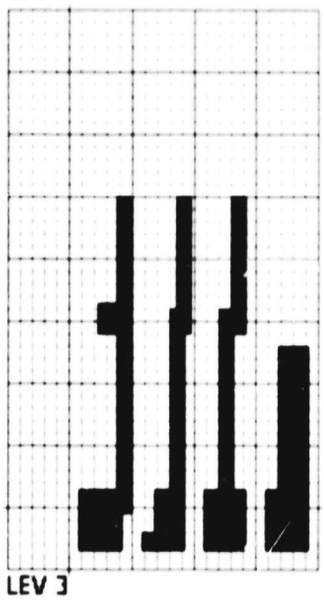

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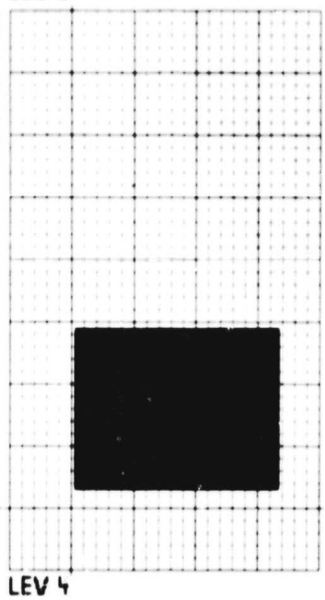

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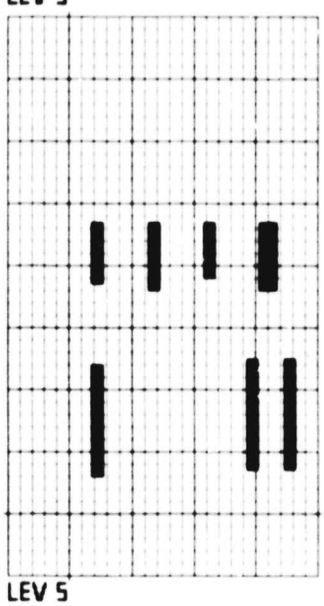

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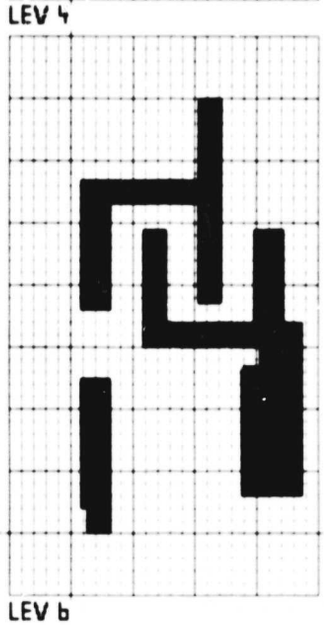

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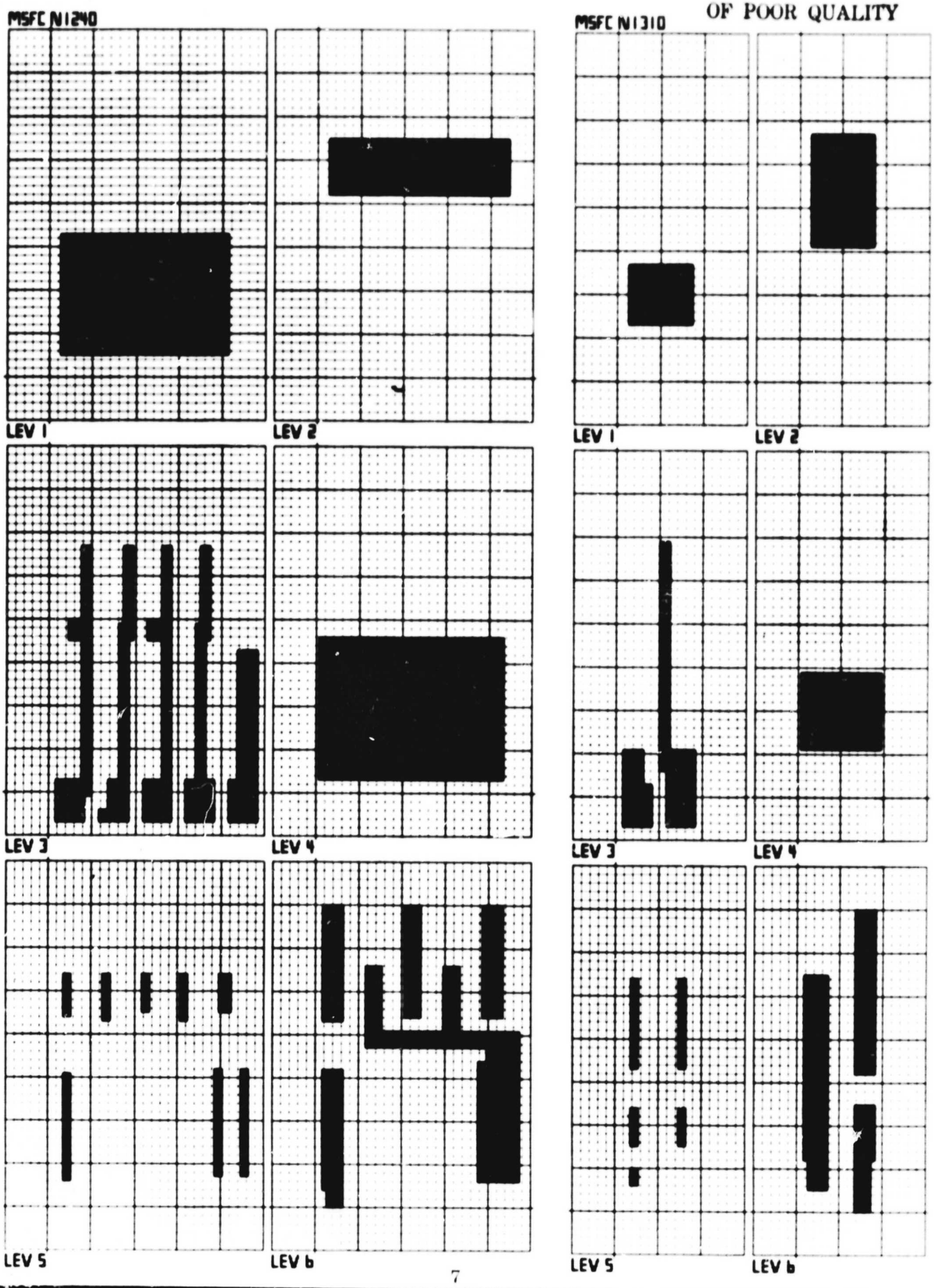

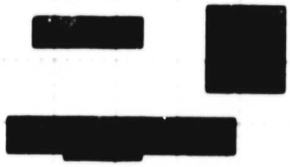

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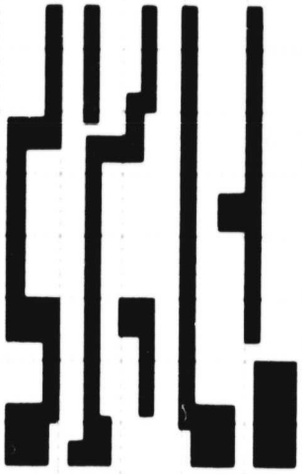

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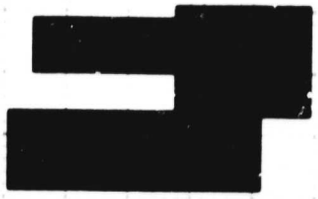

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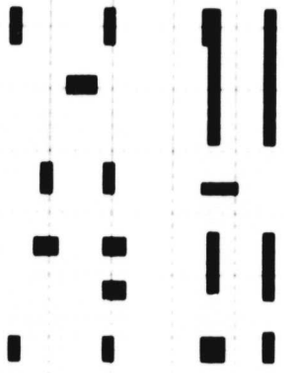

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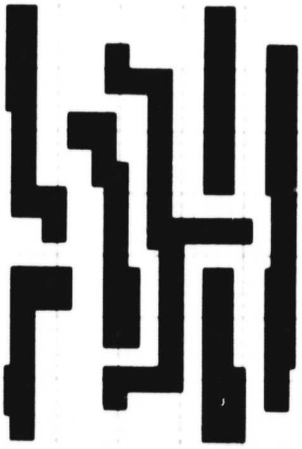

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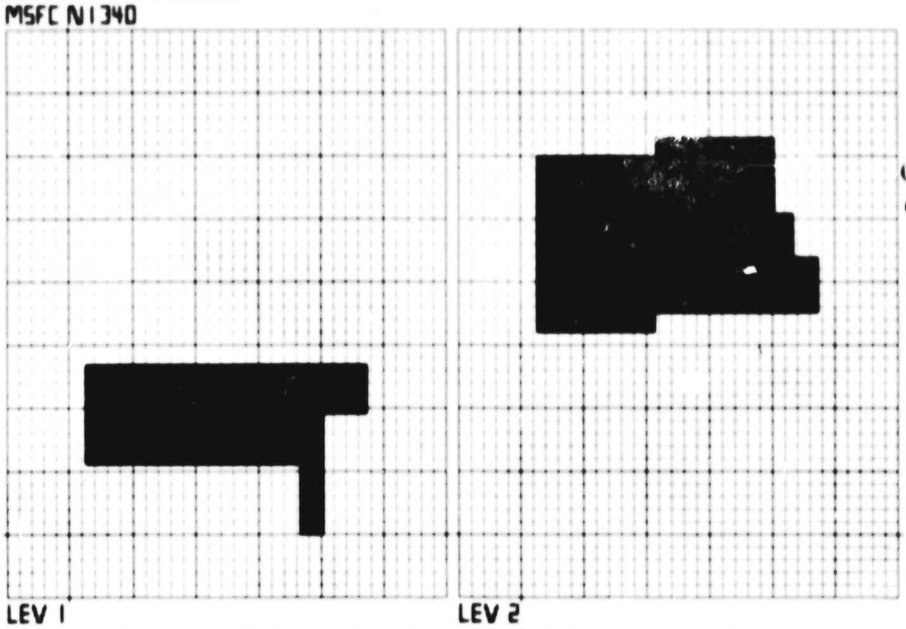

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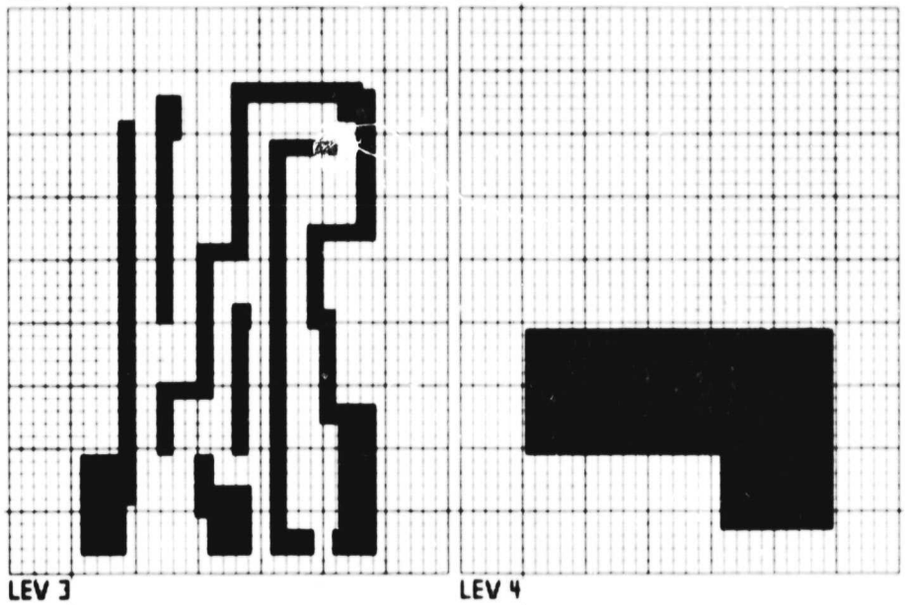

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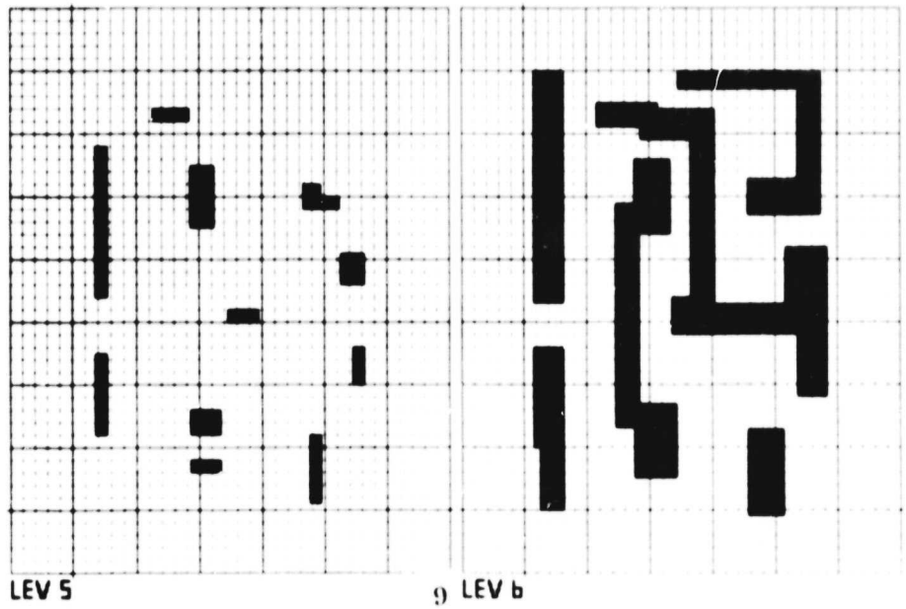

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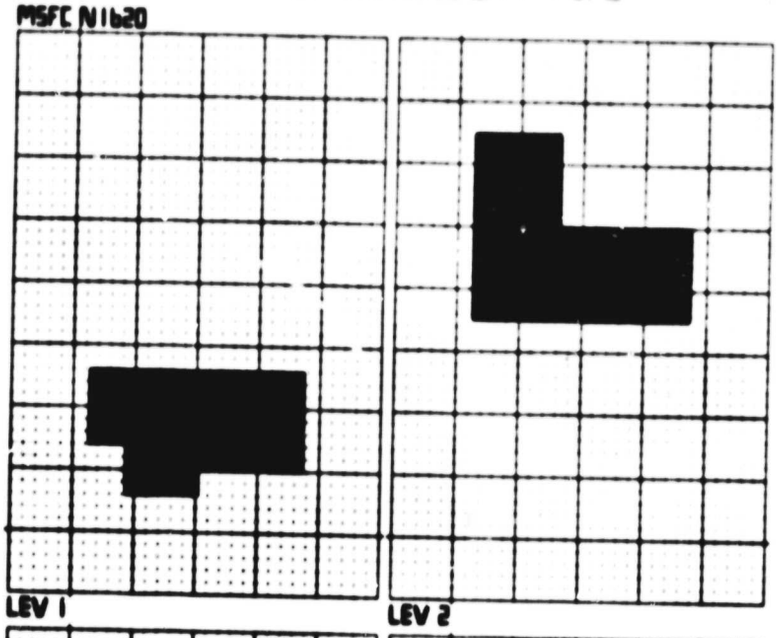
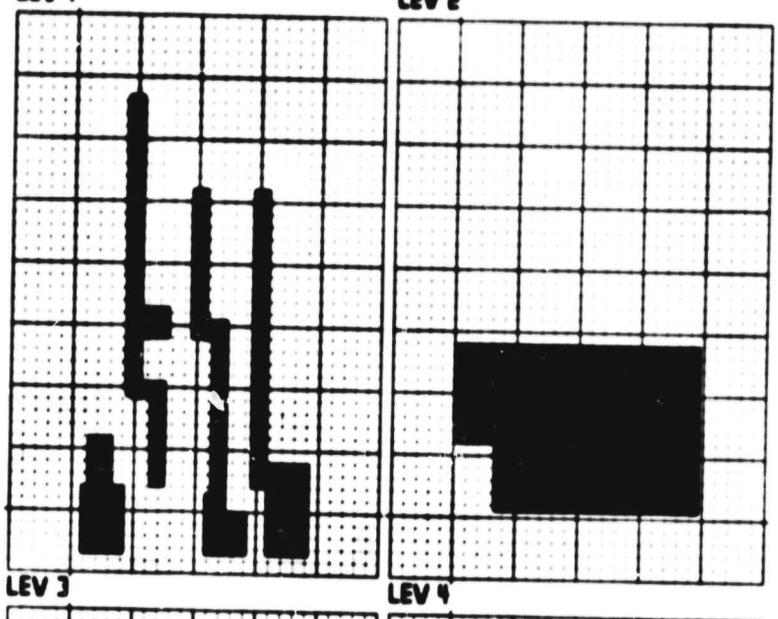
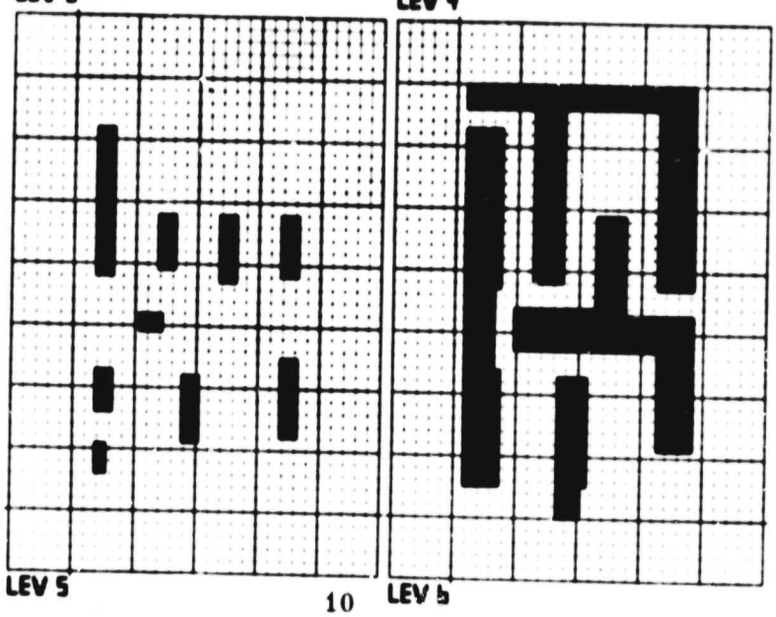
MSFC N1620



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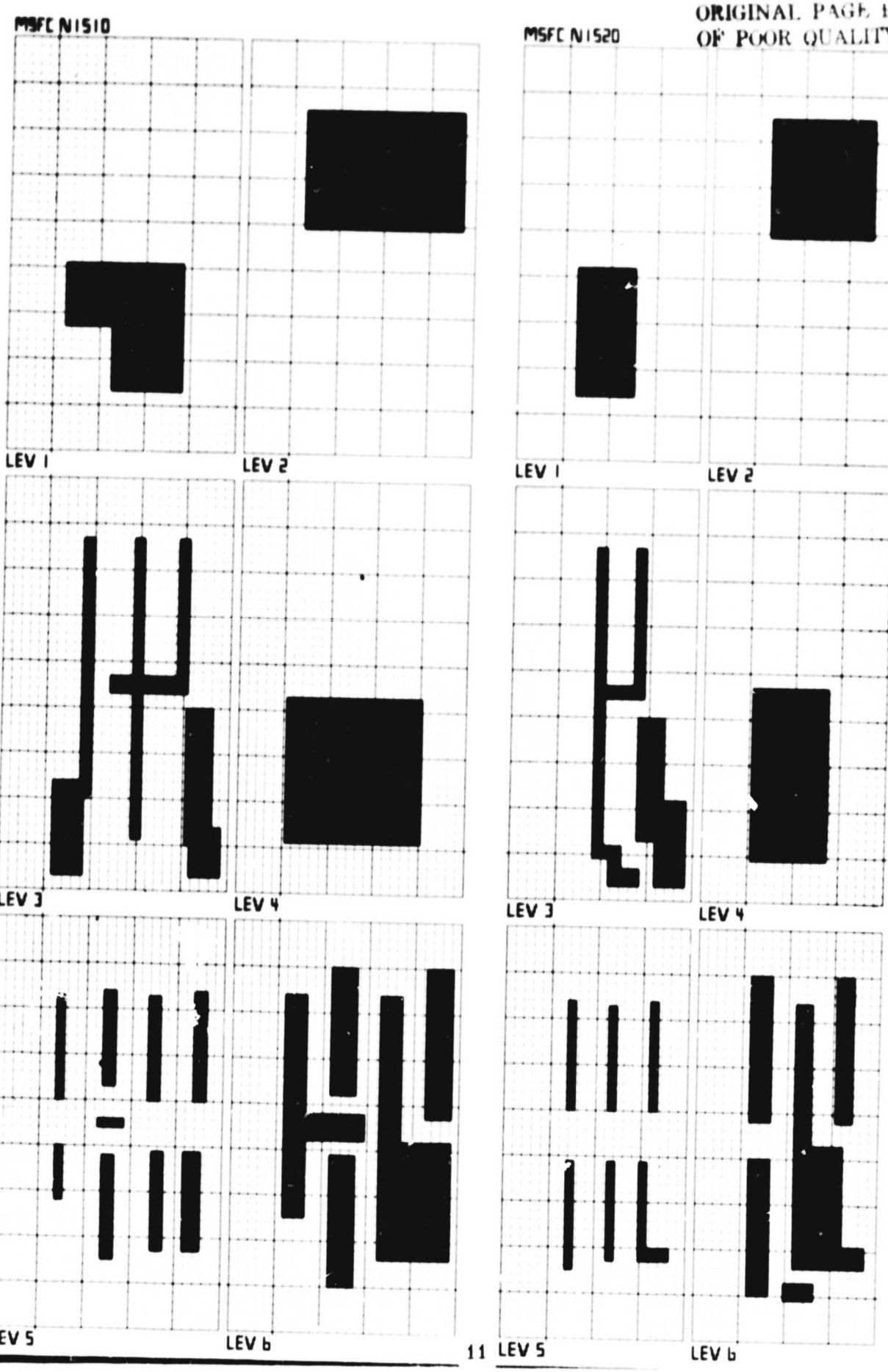

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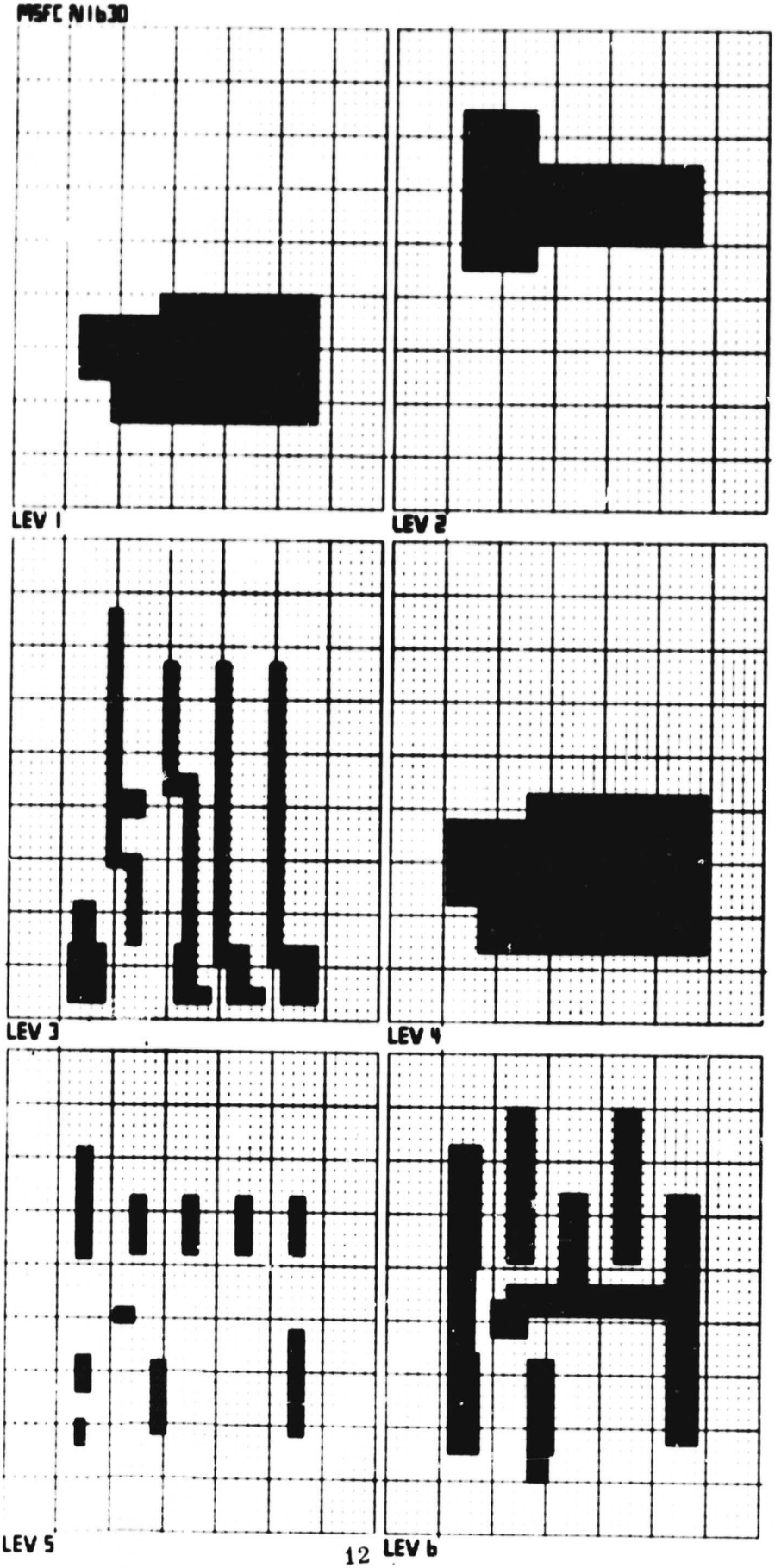

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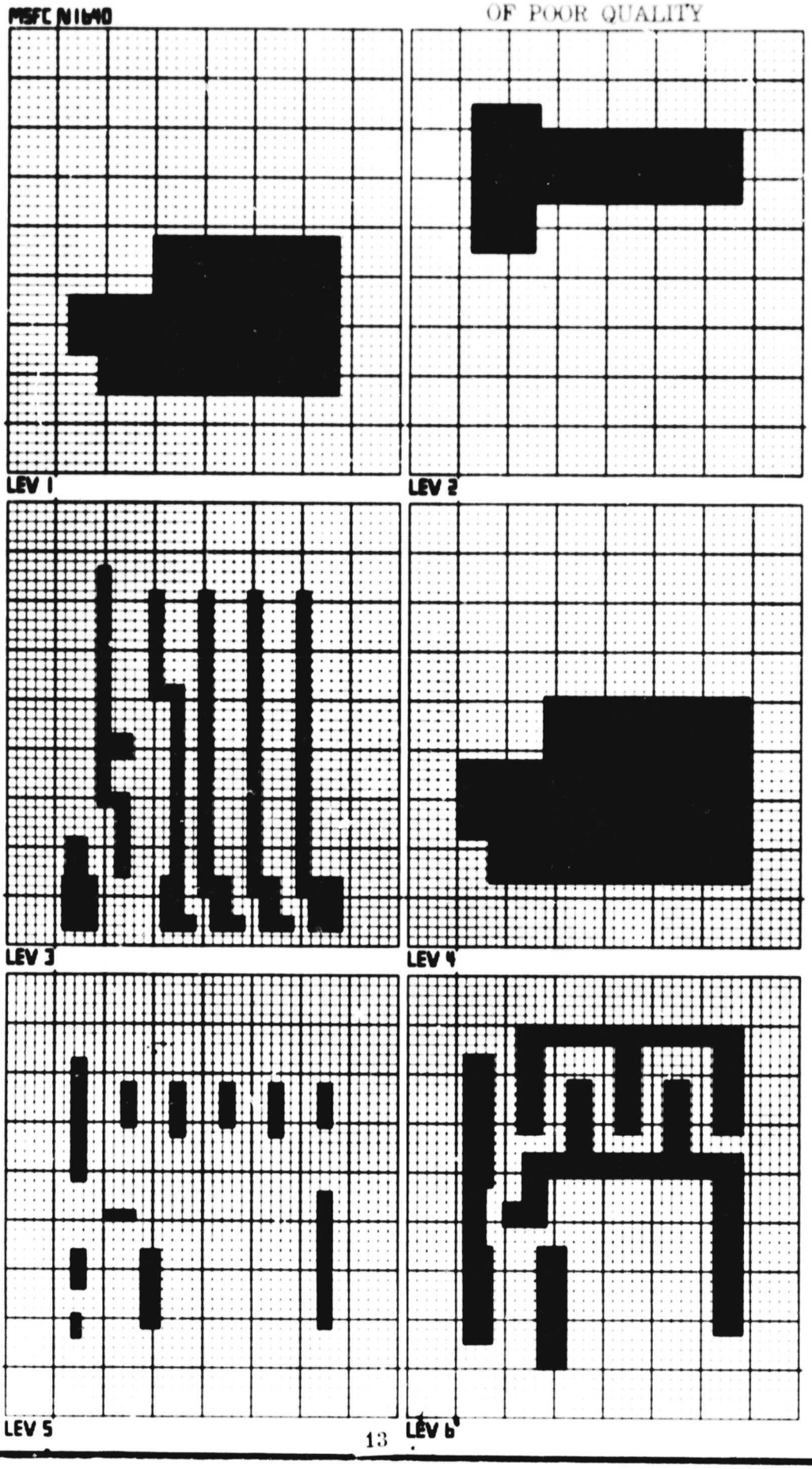

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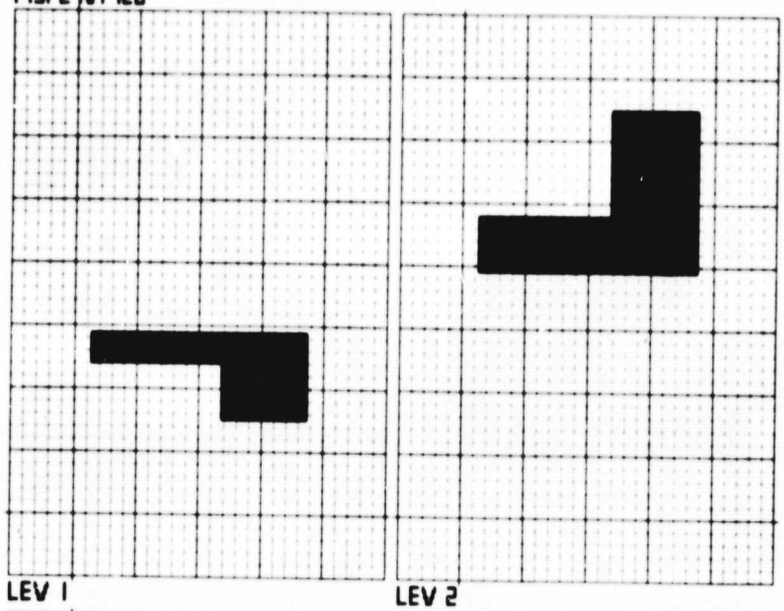

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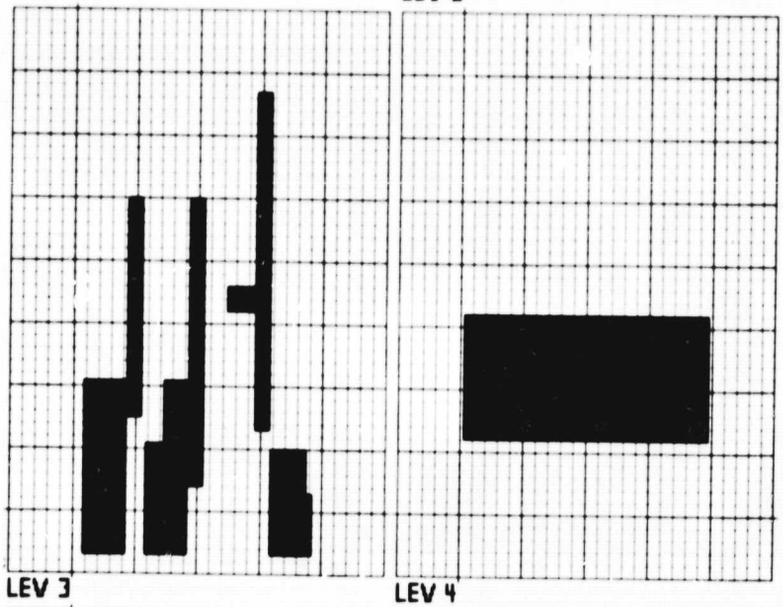

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LEV 5 LEV 6

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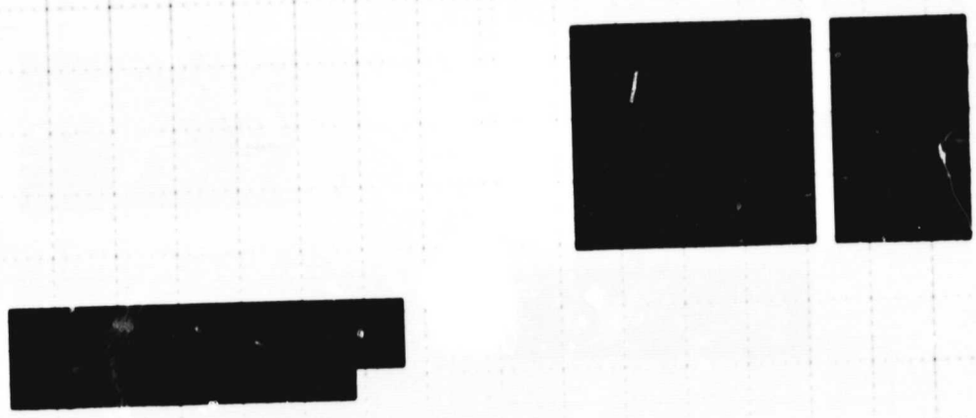

LEV 1

LEV 2

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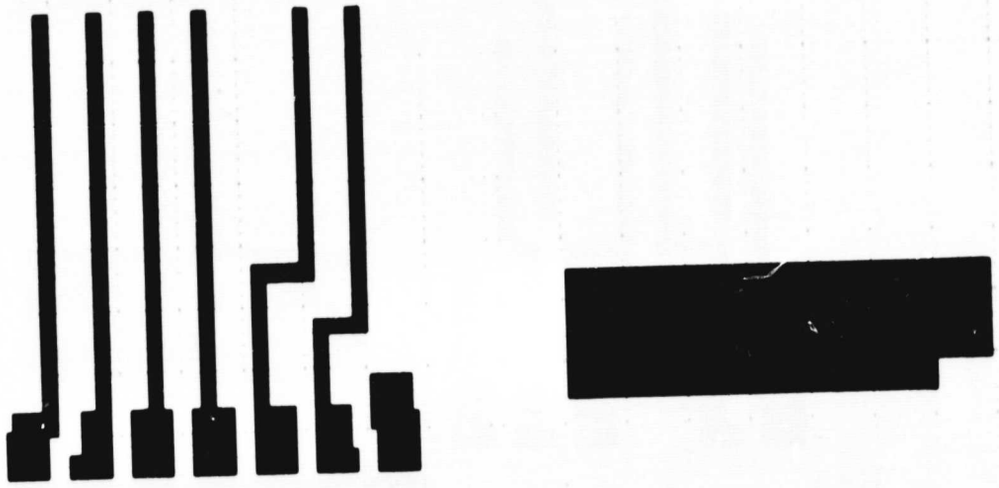
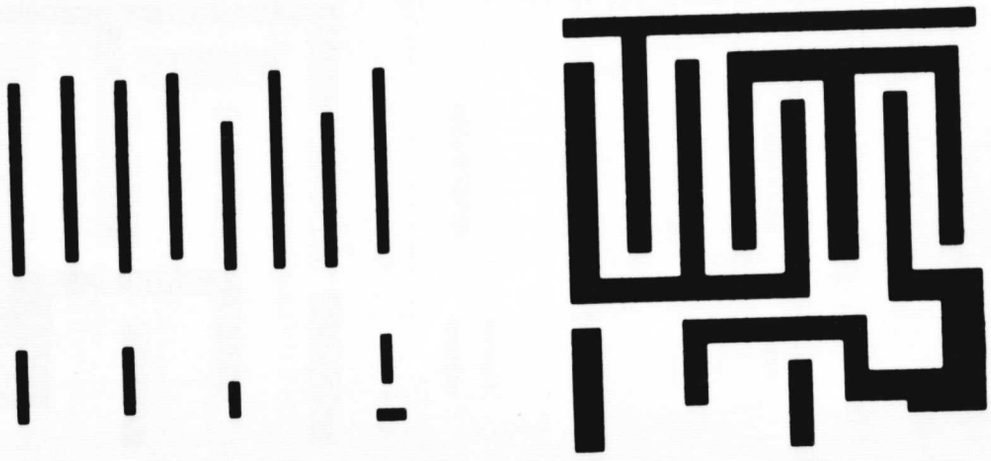
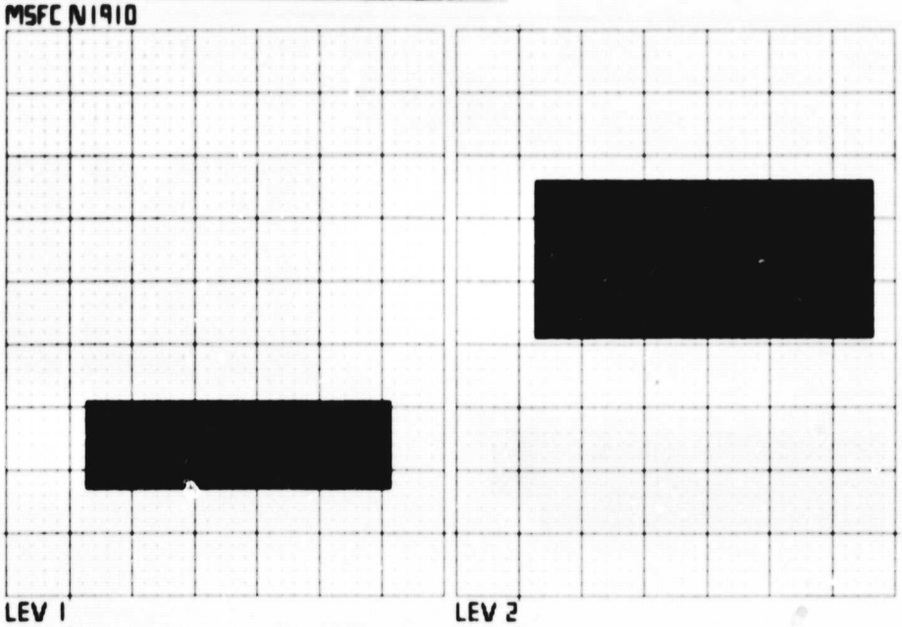


LEV 3

LEV 4





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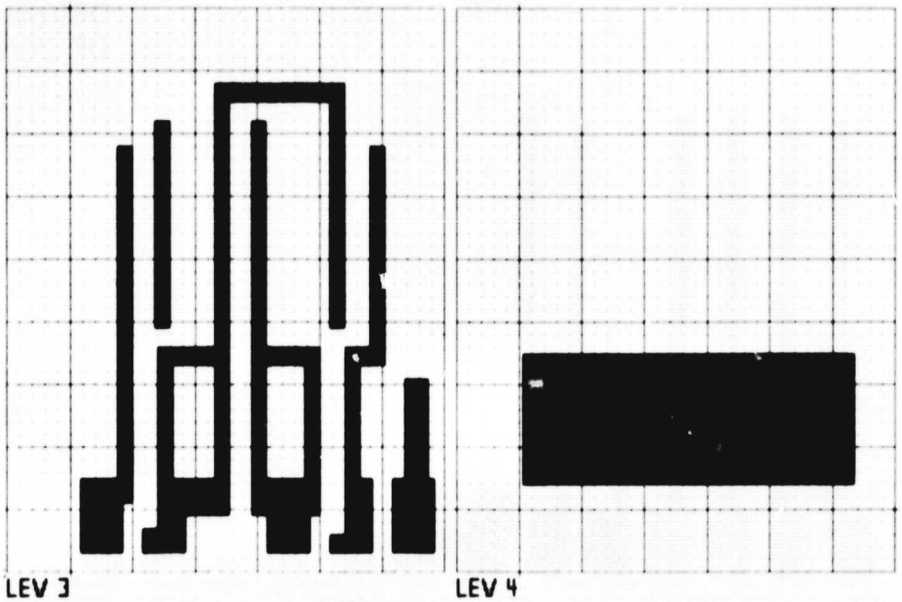
LEV 2



LEV 3



LEV 4

LEV 5



LEV 6

MSFC N1920

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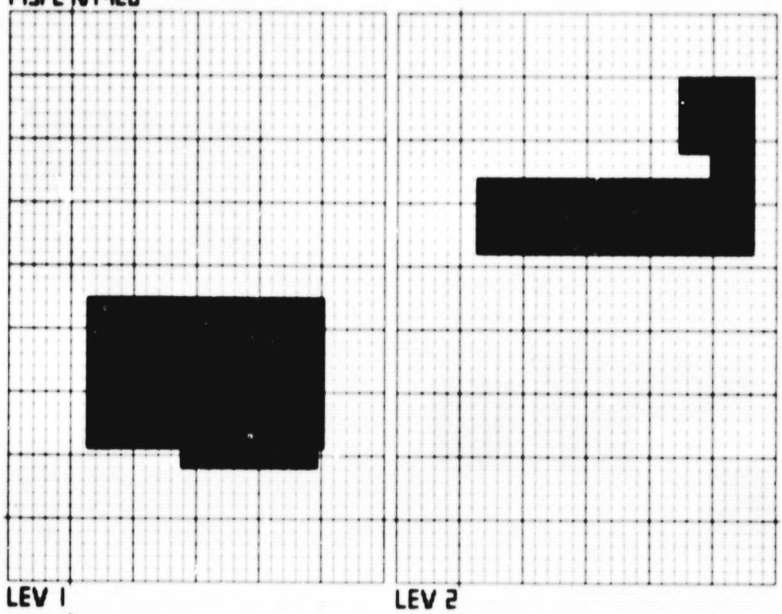

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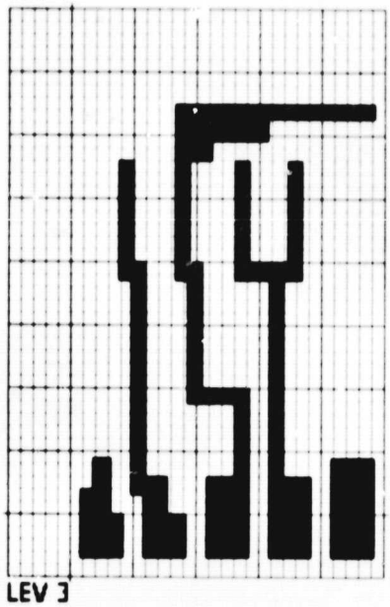
LEV 2



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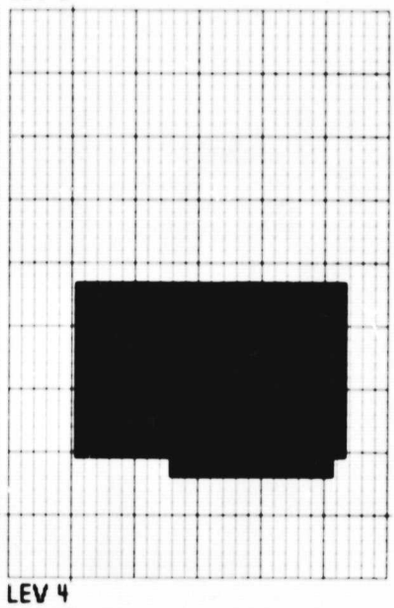

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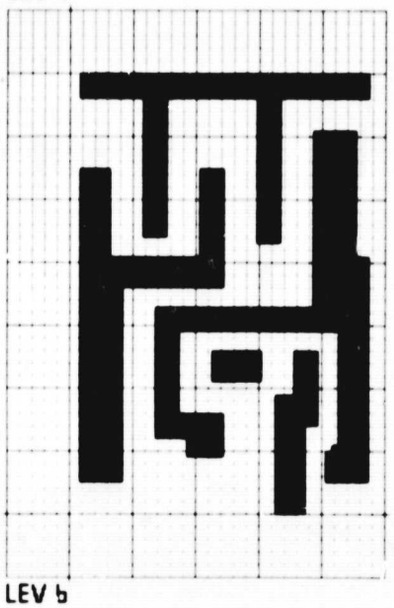

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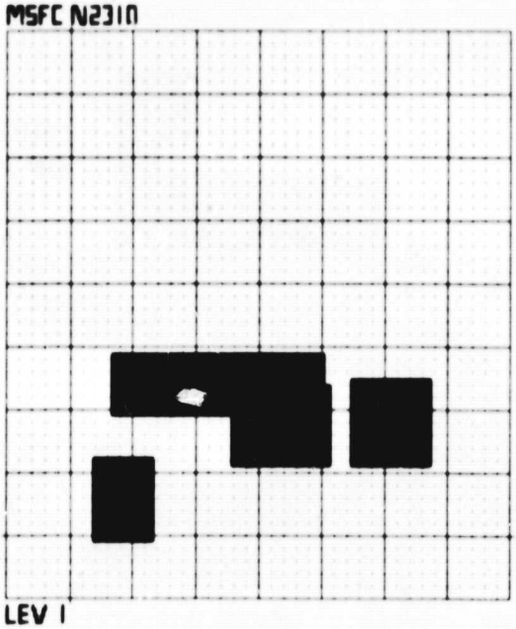

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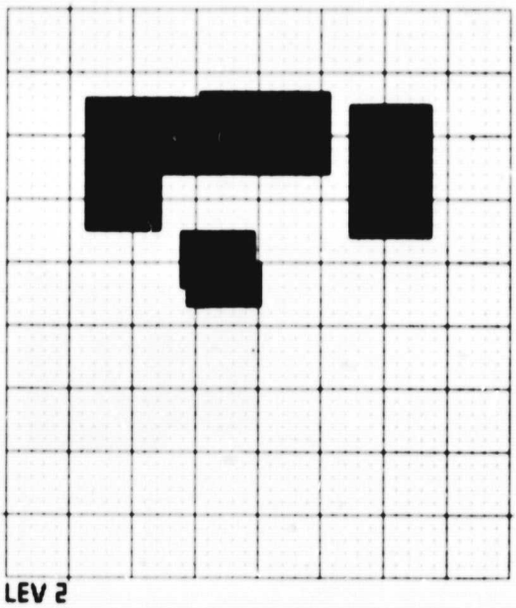

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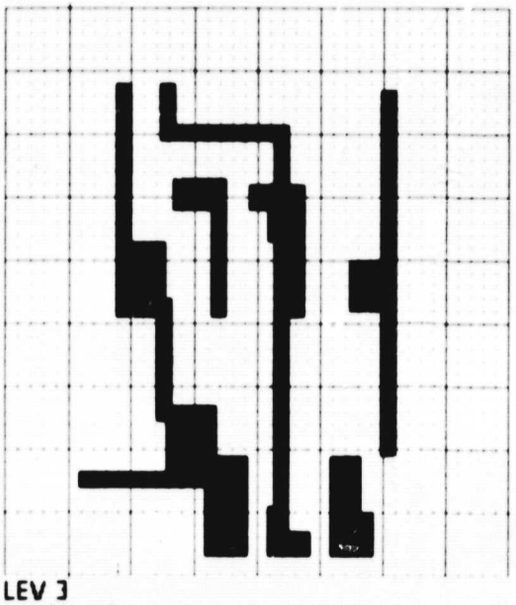

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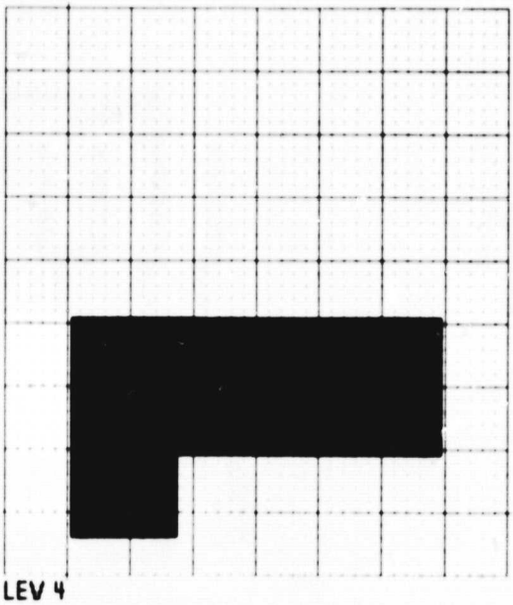

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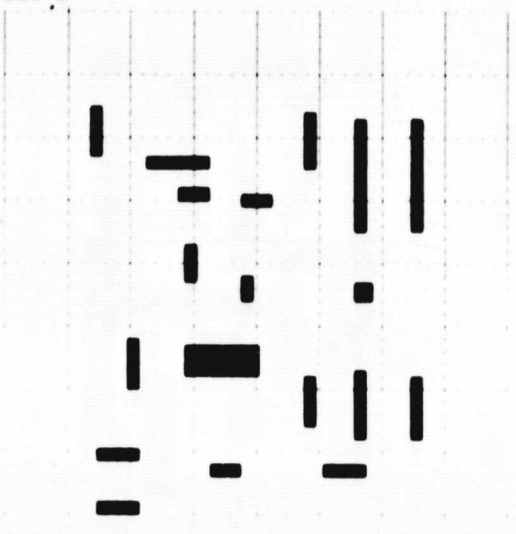

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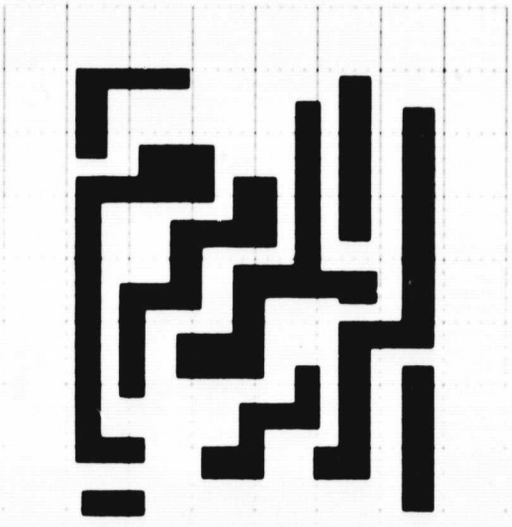

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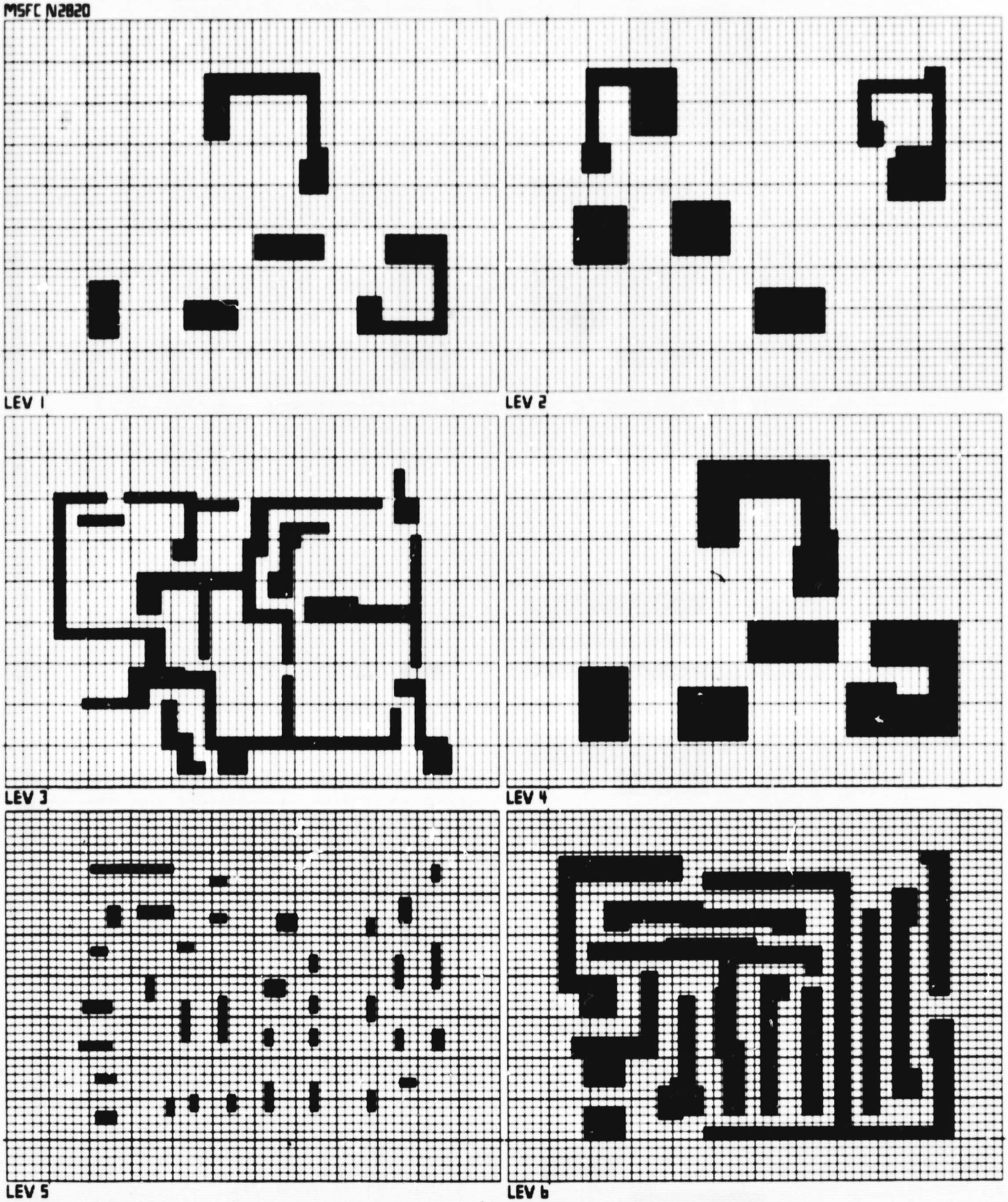

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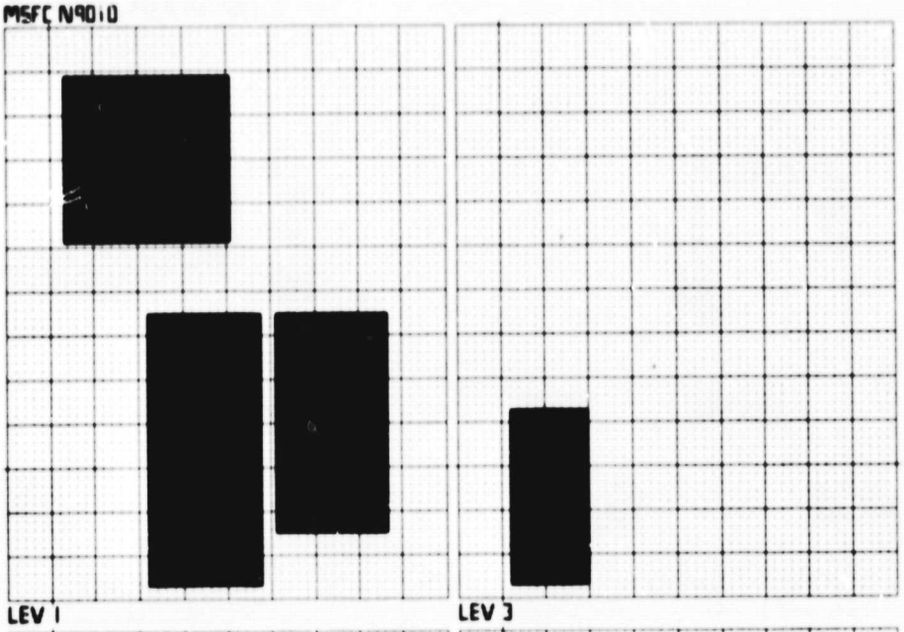
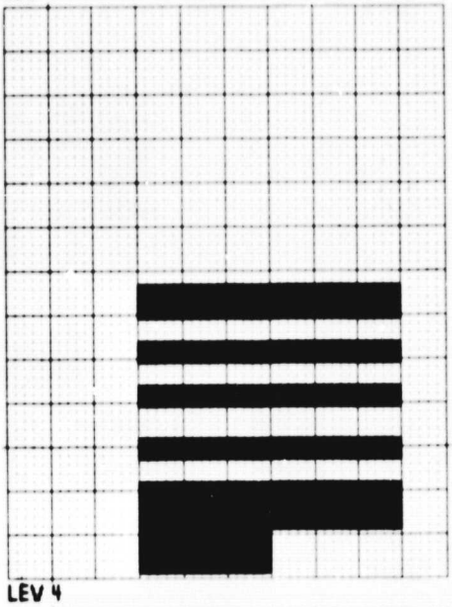


LEV 1



LEV 3



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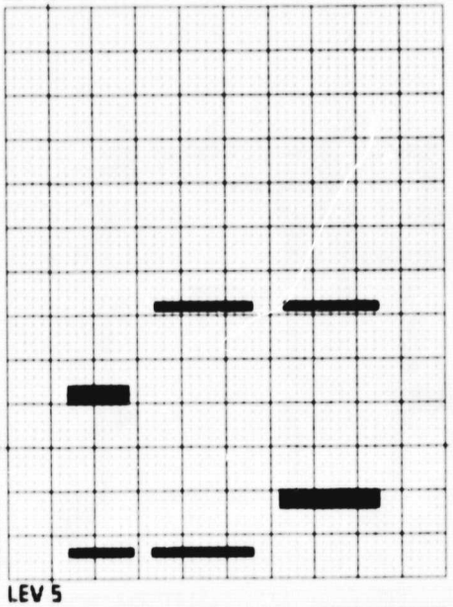

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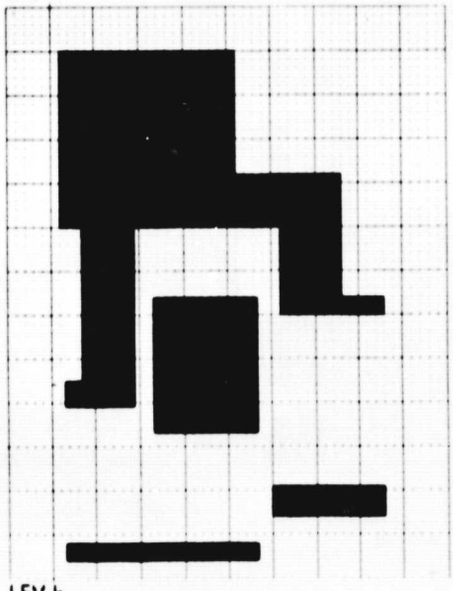

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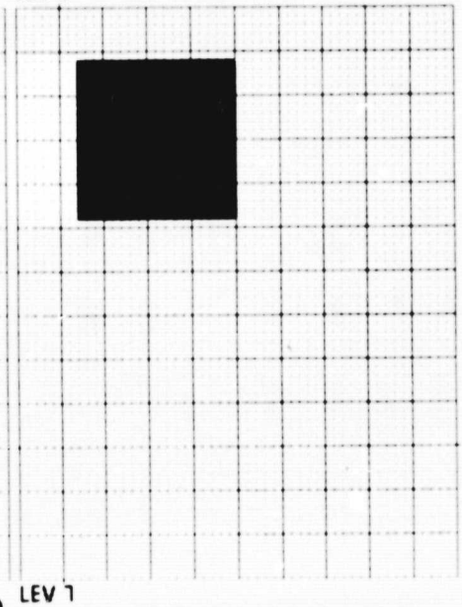

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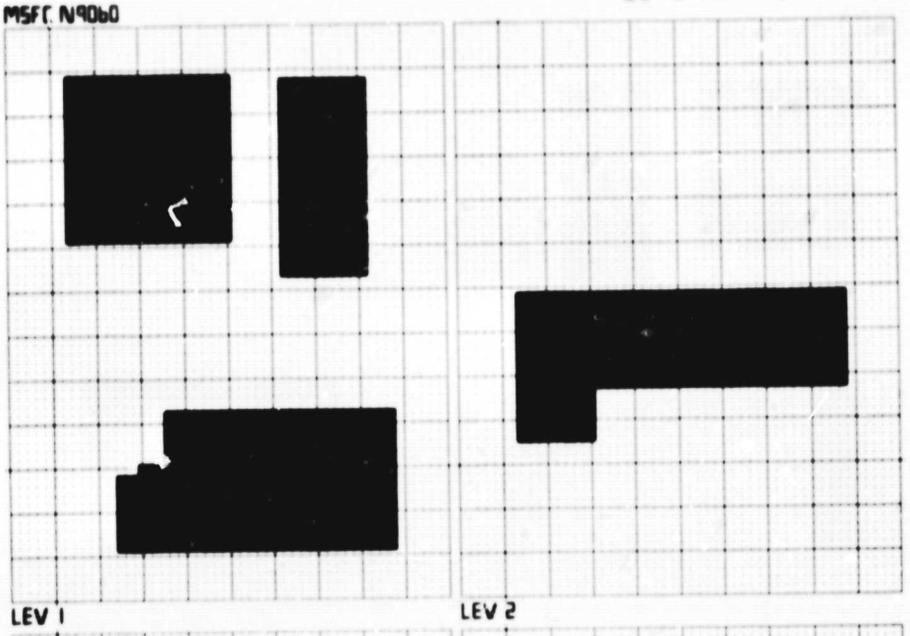


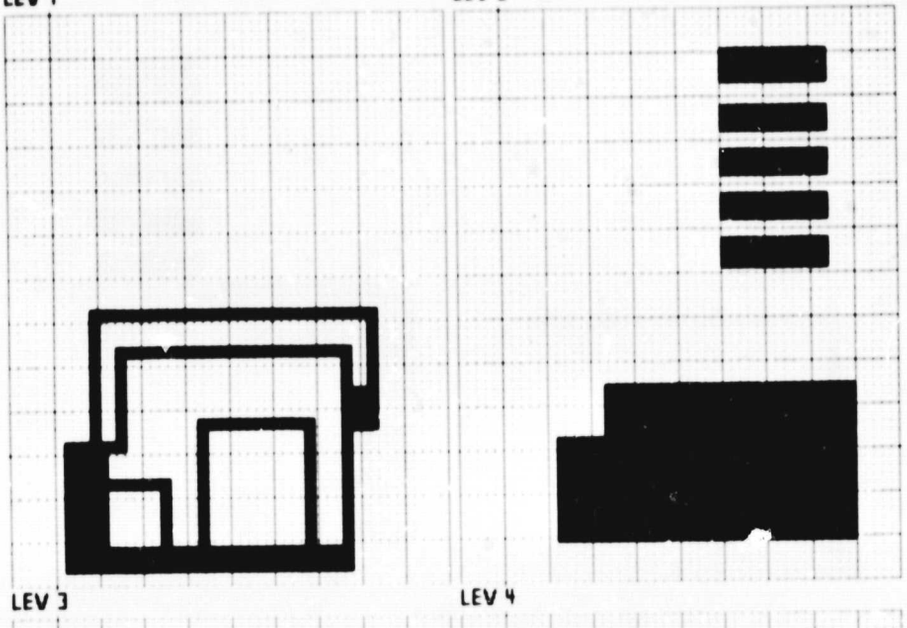


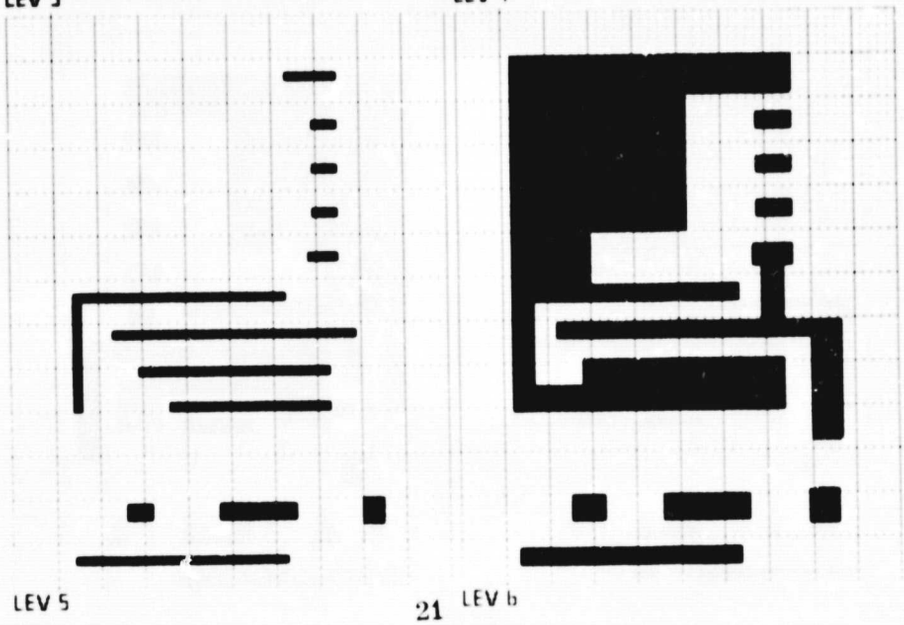

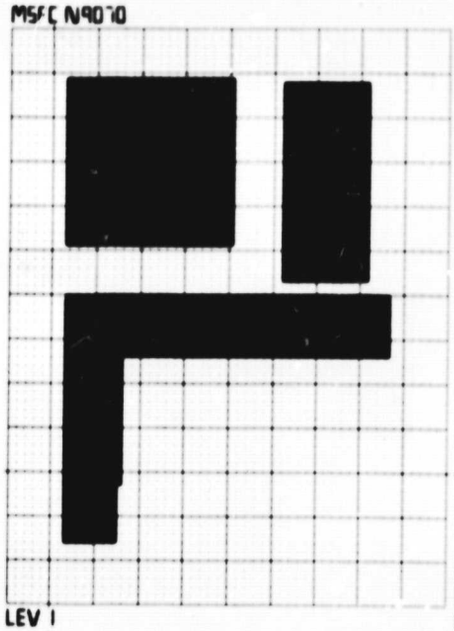

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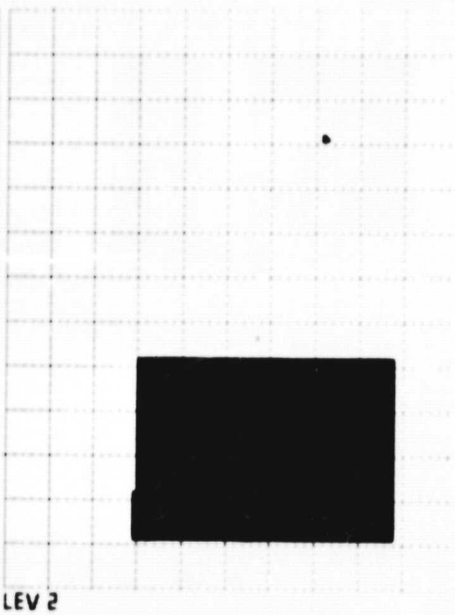

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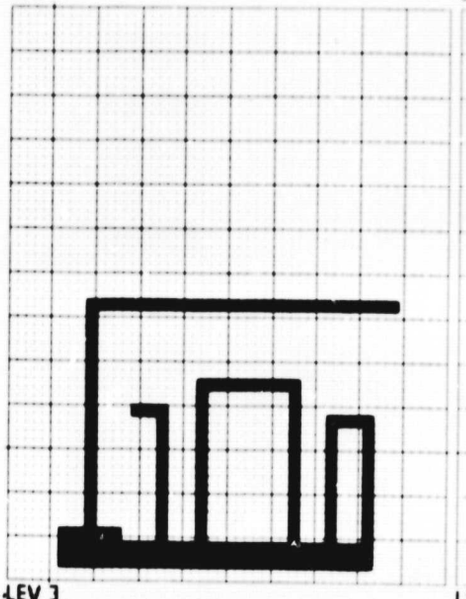

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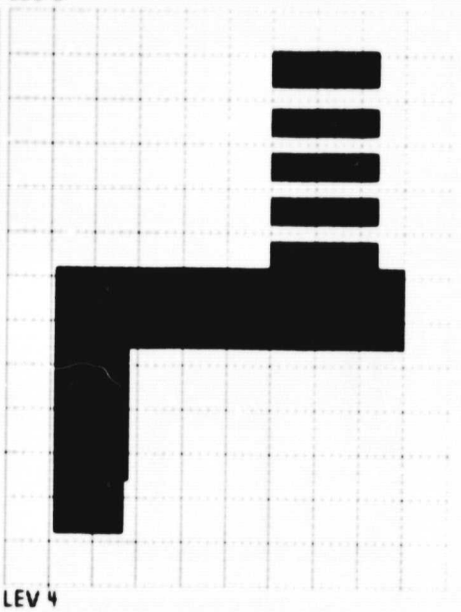

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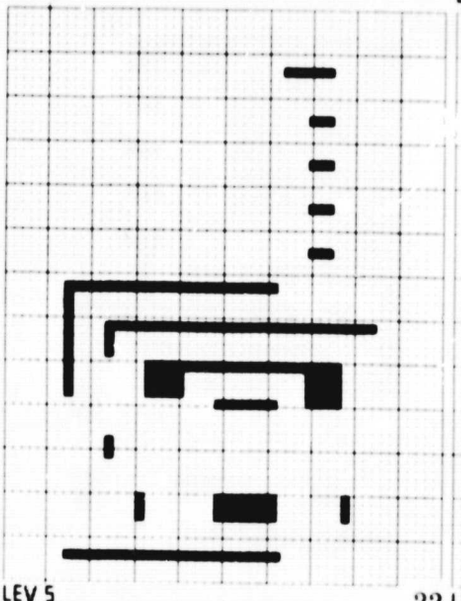

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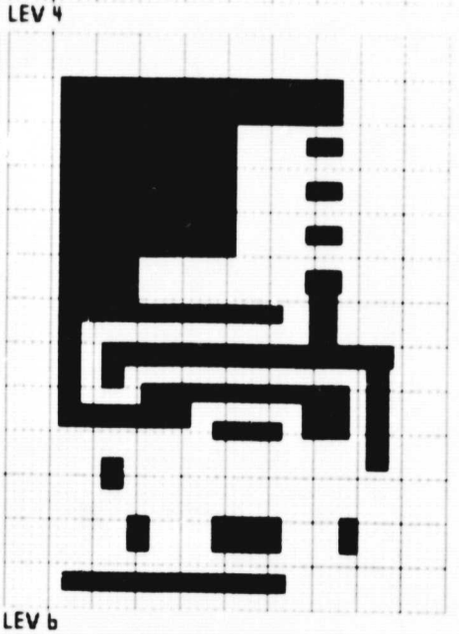

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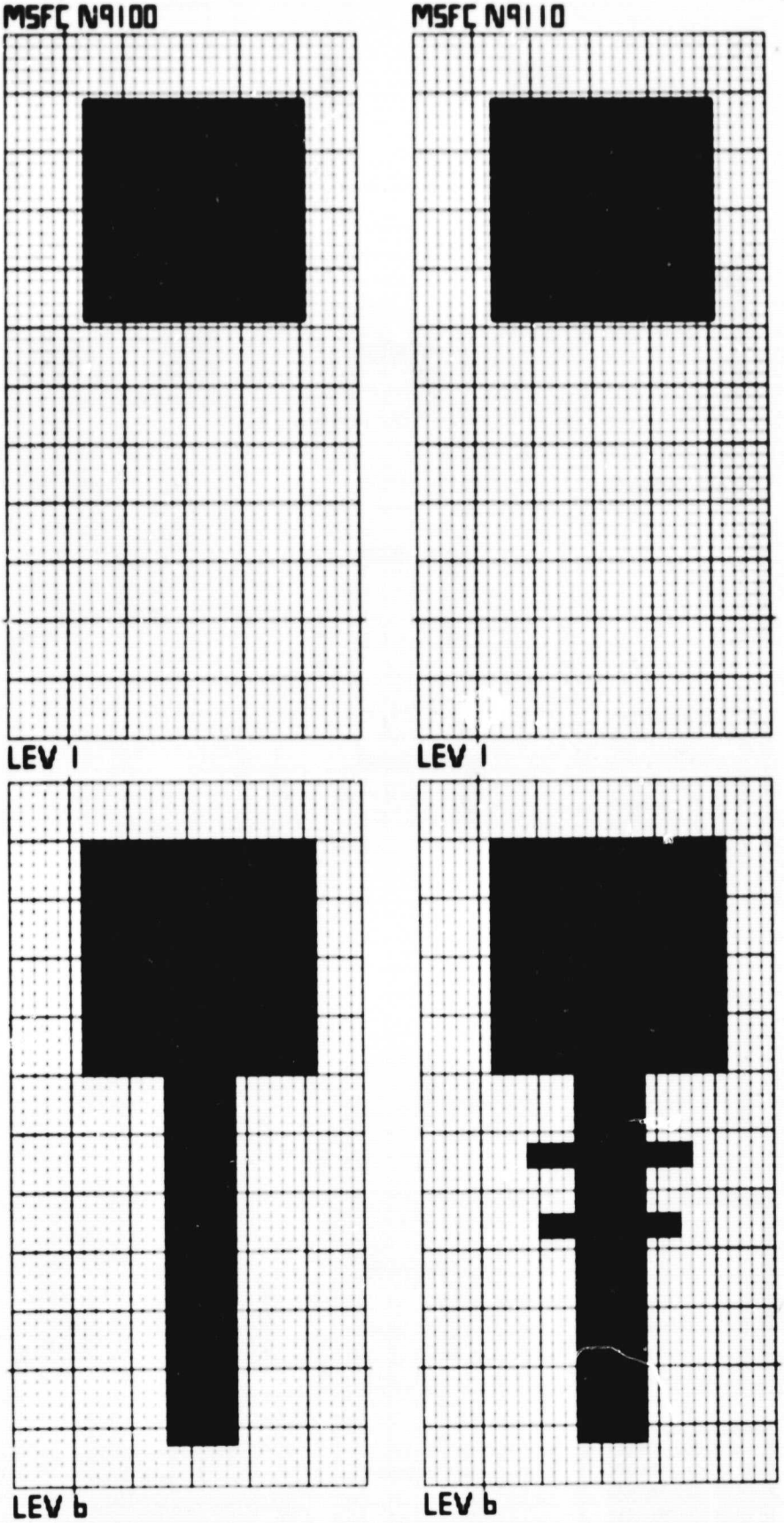

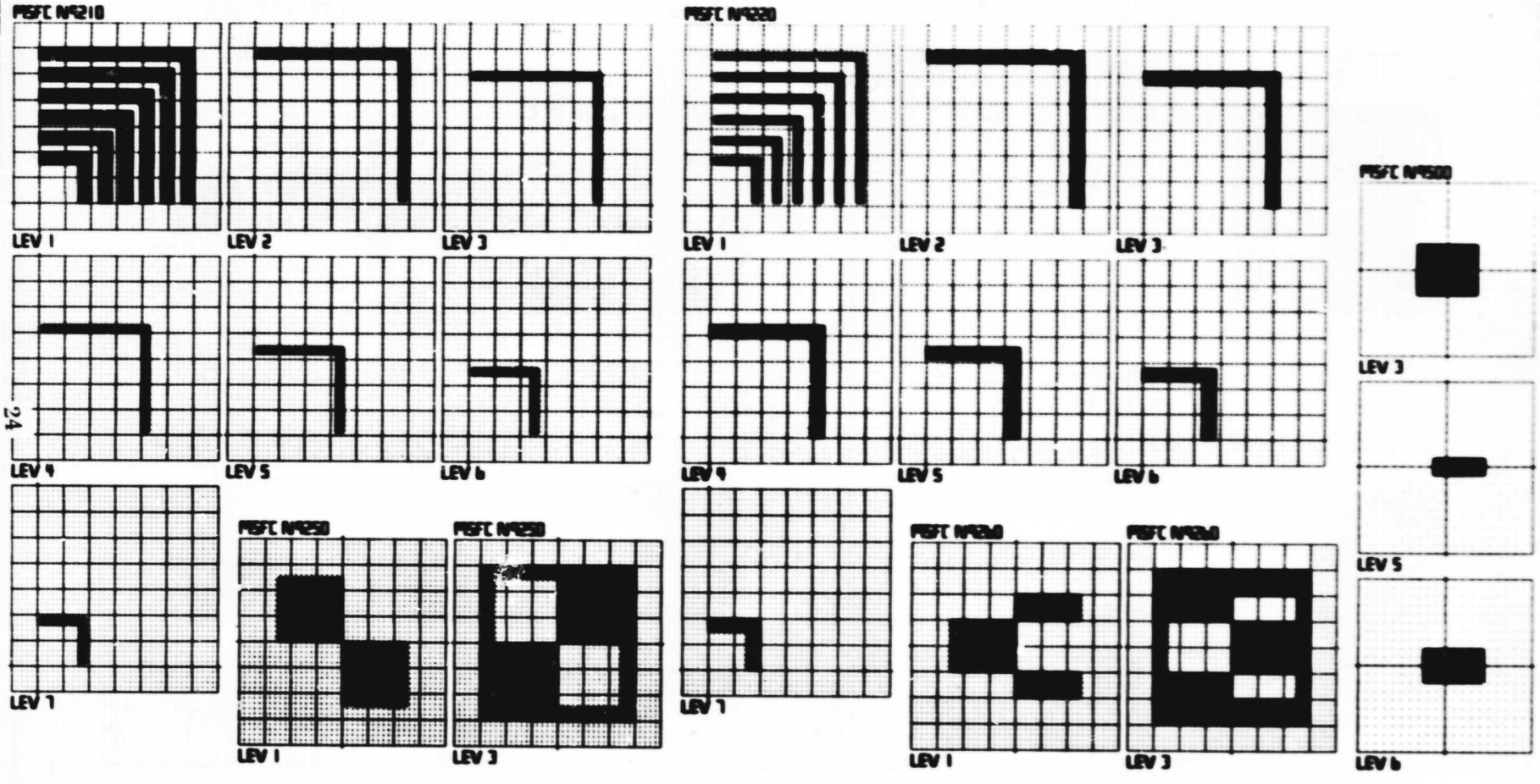
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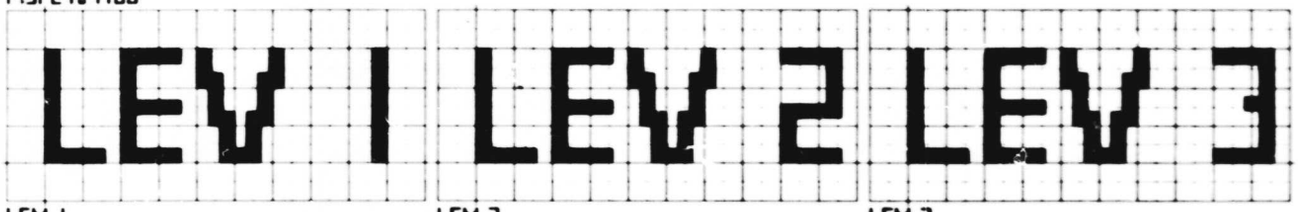
MSFC N9400

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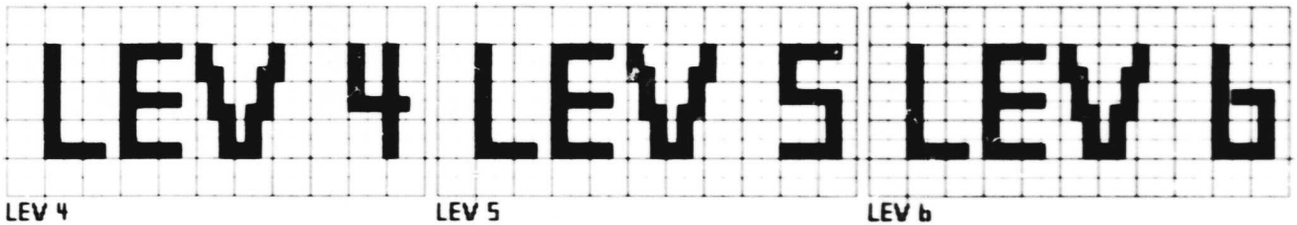
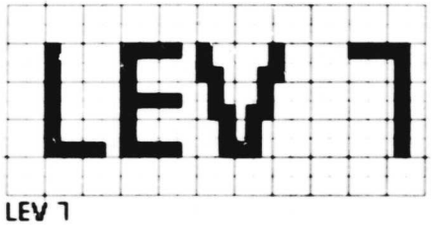



LEV 4 LEV 5 LEV 6

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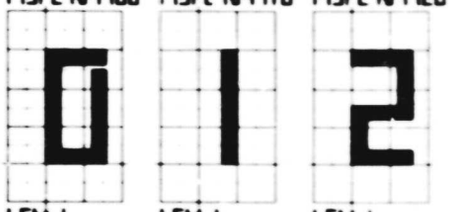


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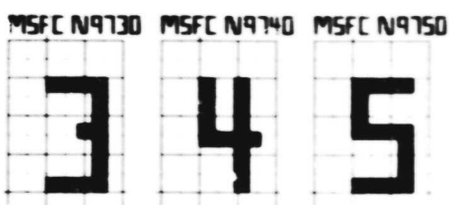


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LEV 1 LEV 1 LEV 1 LEV 1

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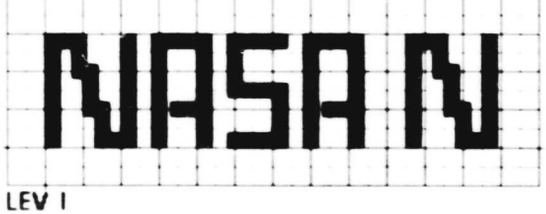


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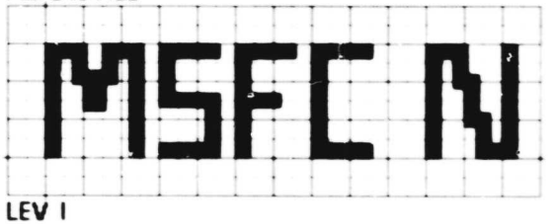


LEV 1

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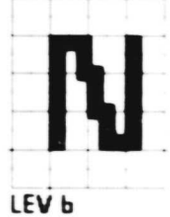


LEV 6

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LEV 6